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Method for Producing Fittings for the Mechanical Processing of a Fibrous Material Suspension

Ins. B1

Sub B2 [0001] The invention relates to a method for producing fittings according to the preamble of claim 1.

Ins. B3

Sub B4 [0002] Fittings produced in this manner are used for the mechanical processing of suspended fibrous material. This means above all refining paper fibers, i.e., changing fiber properties, such as length, flexibility or surface. Fittings are mounted, e.g., in refiners. The suspension in refiners has a solids content of approx. 2 - 8 %, and even more in special machines. Such machines for higher stock consistencies are called, e.g., high consistency refiners, dispersers or kneader pulpers. Conventional machines have at least one rotor and at least one stator with either disk-shaped or conical surfaces on which the fittings are mounted, so that gaps can form between them. Many fittings feature ridges and grooves on the working surfaces, which is why they are also called "knife fittings." It is known that in addition to the shape of such ridges, the material they are made of also has an impact on the processing of the fibrous material.

[0003] The fittings are exposed to wear and therefore have to be replaced at certain intervals. Moreover, the wear can lead to a change in the processing effect during the operating lifetime, since form and surface of the fittings have a critical impact on the processing effect.

[0004] It is therefore understandable that a considerable expense is being devoted to developing fittings, which is reflected in the design of their shape and in the selection of the material. It has turned out that materials that are particularly suitable for the processing elements have properties that can be very problematic when they are used for the base body of the fitting.

[0005] This applies in particular to materials that are very hard and brittle, such as, e.g., ceramics, and that therefore do not have the toughness necessary for the base body. Furthermore, such materials are relatively expensive and difficult to manufacture and can be processed only at great expense, compared with normal metallic materials.

[0006] The base body of a processing tool provides the connection between the processing elements and the other components, e.g., those of a refiner. Because of the high forces that occur in such a refiner, particularly exacting demands are made on the base body in terms of strength. It also needs to be possible to attach it securely to the refiner, for which, e.g., highly tightened screws are necessary. Due to these requirements, a particularly strong and tough material is necessary.

Sub B5

[0007] A method for producing fittings is already known from DE 197 54 807 A1, where they are assembled from parts manufactured separately. This publication suggests joining the processing element to the base body by means of vulcanization. There are cases in which this is not the best possible type of mounting.

[0008] With the mechanical processing methods mentioned at the outset, a heating of the fittings occurs. This is due to the high energy density of the processing procedure and is, e.g., particularly intense when higher stock consistencies are refined. Damage to the fittings can then occur, if the connected materials, e.g., ceramics and chromium steel, have different thermal expansion behaviors. The types of ceramics that are particularly suitable have a noticeably lower thermal expansion than chromium steel. As a result, the bond can rupture, which leads to a fatal fracture of the fitting. Moreover, ceramics of this type are very brittle, so that cracks can occur due to thermal expansion in the case of a rigid, flat bond or several rigid fastening points.

[0008.1] Rotor and stator disks for use in a refiner that is used for refining paper fibers are known from US 4,620,675. The disks feature processing elements that are directly secured to the disks used as rotors or stators, e.g., they are bonded to them. They are made of an elastic material in such a way that an axial flexibility of the processing elements is possible without having to displace the disks themselves. The same refining power is thus effective in all the refining gaps. This is therefore a special construction for those refiners that do not require detachable fittings. Various materials are given for achieving the elasticity of the disks, including a fiberglass/epoxy resin composite.

[0008.2] Fittings that are also suitable for use in a fibrous material refiner are known from US 5,836,525. Here a base body is provided with a wear resistant coating. Several alternatives are given for the material of the base body. It could be metal or plastic, e.g., polyamide or a mixture of epoxy resin and glass fibers or carbon fibers. A certain amount of choice of possible materials is also given for the coating of this base body, i.a., various types of ceramics. A fitting produced in this way is presumably relatively temperature-sensitive, i.e. it has only limited strength in fluctuating temperatures. Moreover, its manufacture is very difficult and costly.

Ins. B6

[0009] The object of the invention is to configure the method for producing fittings such that brittle materials that are particularly suitable can be used for the processing elements, and that the fittings are unaffected by heat.

SubB7 [0010] ~~This~~ object is attained by the features specified in the characterizing part of claim 1.

[0011] With production methods of this kind, a different material is therefore used for the processing elements than for the base body as is known per se. This has the significant advantage that the material selection for the processing elements can be adapted to the desired processing technology, while a material with a high degree of strength and toughness is used for the base body. Plastic material is given a high degree of strength and toughness by embedded carbon fibers. These properties can be used to particular advantage to attain the object, if its thermal expansion behavior is adapted to that of the material preferred for the processing elements. Changing and thus regulating the thermal expansion behavior of carbon fiber reinforced plastic is absolutely possible. Thermal expansion coefficients can be "built in" and, if desired, even modified in different directions. There are also glass-fiber reinforced plastics with properties that can be adapted according to these requirements.

[0012] Fittings produced according to the invention have surface properties constant in time and are highly wear-resistant, mechanically sturdy, thermally insensitive and light in weight.

It should be noted that there are ceramic materials that have a thermal expansion behavior which can be adapted to that of steel, e.g., of chromium steel suitable for the base body. However, such materials are not so good at meeting the technical and economic demands made on the processing element.

Ins.B8
SubB9 [0013] The invention is explained by means of diagrammatic drawings. They show:

Fig. 1 in perspective: a fitting produced according to the invention;

Fig. 2 a fitting produced according to the invention in side view in section;

Fig. 3 a typical refiner fitting in plan view;

Fig. 4 and 5 in perspective: further fittings produced according to the invention.

InsB10 [0014] Fig. 1 shows the base body 1 with a connected processing element 2. The strips 5 of the processing element 2 protrude around the projection c and have a plurality of faces 11, resulting in a refiner fitting, which is also called a knife fitting. A force-locked join is made, e.g.,

by adhesion on the contact surface 3 of the processing element 2 and the contact surface 4 of the base body 1. The relatively thin adhesive layer thus formed is very strong and largely rigid, i.e., it is not elastic enough to be able to compensate alone for the thermal expansions.

[0015] Fig. 2 shows a similar fitting in side view. One can recognize the base body 1 in section with the processing element 2 mounted on it, which is provided with strips 5 of varying lengths. The shorter is drawn in section. The base body 1 is attached to the rotor 8 of the refiner by detachable connector elements 10, which rotor in turn is driven by the shaft 9. Of course, the fittings produced according to the method can also be attached to a stator.

[0016] Fig. 3 shows a typical refiner fitting in plan view. Segment-shaped processing elements 2 are located on the annular base body 1. These support strips 5 with a width b, are straight and in part of differing lengths. Curved strips or strips tilted more against the radius are also conceivable. The method according to the invention can also be used if processing elements 2' with faces 11' featuring an abrasive, porous surface, as shown in Fig. 4, are to be used instead of processing elements provided with strips.

[0017] In the example shown in Fig. 5, recesses 6 are made in the base body 1' into which the complementary elevations 7 of the processing element 2' fit such that a stop is formed on one side (left example). An exact positioning of the processing element can thus be made before connection, and the strength of the connection can be increased. Other elevations 7' can also fill recesses 6' and, e.g., be cast as well in the plastic of the base body (right example).

Other possibilities are conceivable for producing a strong bond between processing element and base body. As an alternative or in addition to a flat, i.e., force-locked join, a plurality of mounting elements distributed over the contact surface can join the two parts together with a form-locked join. If there are enough of them, the forces can be transferred evenly to the brittle processing element. The production of the fittings according to the invention also makes it possible to join the mating parts during the curing of the plastic.